

A Compact, Lightweight Electrically Driven Propellant Pump with High Pressure Rise, Phase I

Completed Technology Project (2018 - 2019)



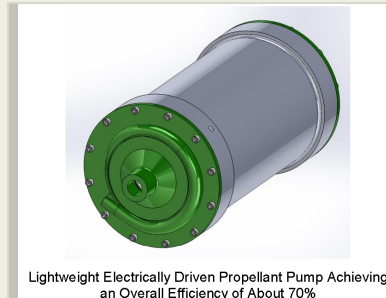
Project Introduction

Reducing the inert mass of propulsion systems in sample return spacecraft will reduce their launch costs and increase opportunity for these missions. Compared to a pressure-fed system, a propellant pump-fed system can significantly reduce overall propulsion system mass, especially for a system with high propellant throughput. To address this need, we propose to develop a compact, lightweight electrically driven propellant pump that can achieve a high pressure rise to increase the thruster chamber pressure, and thus the propellant specific impulse. The pump operates at very high speeds to achieve a high pressure rise, high power density, and high efficiency. The miniature pump impeller is produced by Creare's proprietary fabrication processes to achieve high hydrodynamic efficiency. The fabrication process is built on Creare's space-qualified, high-speed miniature turbomachine technology. In Phase I, we will demonstrate the feasibility of our approach through detailed design analyses for the propellant pump and assessment of its performance benefits over a pressure-fed system, as well as demonstration of critical component technology. In Phase II, we will build and test a propellant pump and delivery it to NASA for further evaluation.

Anticipated Benefits

The technology developed in this project will reduce the inert mass of spacecraft propulsion systems. The pump will provide high-pressure propellant to increase the propellant specific impulse. The technology also has applications in spacecraft for sample return missions, spacecraft refueling systems, and circulation pumps for thermal management systems.

The propellant pump technology also has applications in military and commercial spacecraft that require very high maneuverability, commercial small satellites/CubeSats, launch vehicles, and sounding rockets.



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Table of Contents

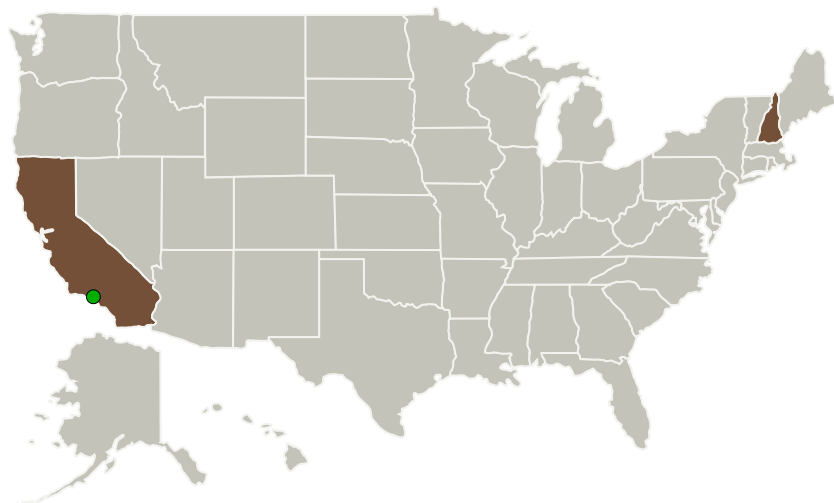
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New Hampshire

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141193>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Creare LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

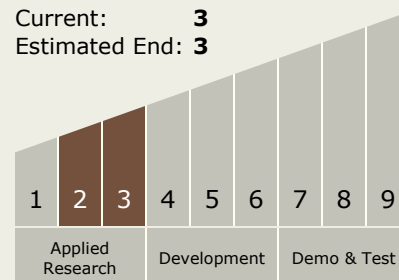
Carlos Torrez

Principal Investigator:

Weibo Chen

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**

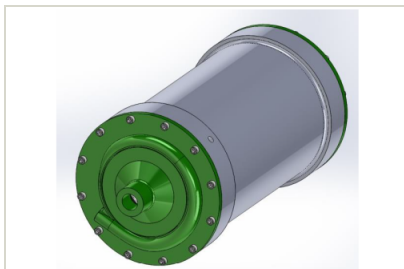


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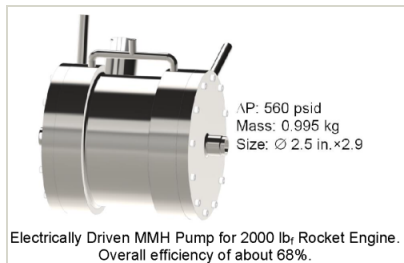
Images



Lightweight Electrically Driven Propellant Pump Achieving an Overall Efficiency of About 70%

Briefing Chart Image

A Compact, Lightweight Electrically Driven Propellant Pump with High Pressure Rise, Phase I
(<https://techport.nasa.gov/image/131290>)



Final Summary Chart Image

A Compact, Lightweight Electrically Driven Propellant Pump with High Pressure Rise, Phase I
(<https://techport.nasa.gov/image/131560>)

Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Moon, Mars, Others Inside the Solar System